

Application No. 10/711,717
Response dated December 30, 2005
to Office Action mailed September 30, 2005

REMARKS

The Examiner has rejected claims 1-14 under § 103(a) as being unpatentable over Kaloyeros et al. U.S. Patent No. 6,884,466 in view of West U.S. Patent No. 5,577,263. Claims 15-19 are rejected under § 103(a) as being unpatentable over Kaloyeros et al. in view of Mittendorf et al. U.S. Patent No. 5,209,388. Claims 1-19 are rejected under the judicially created doctrine of obviousness-type double patenting over claims 1-25 of Cabral, Jr. et al. U.S. Patent No. 6,921,711.

By the amendments herein, claim 1 has been amended to include the limitation from claim 12, and claim 12 has been amended to include a further step in the method. Claims 8 and 10 have been rewritten in independent form. Independent claim 15 has been amended to further specify the type of passivation layer. New independent claim 23 is added, support for which may be found in paragraph 43.

Rejection of claims 1-14 over Kaloyeros et al. in view of West

Applicants respectfully traverse on the basis that there is no *prima facie* case of obviousness. With respect to independent claim 1, which is equivalent to original claim 12 rewritten in independent form, it is the Examiner's position that Kaloyeros discloses producing a tungsten nitride film on a rhenium film, and that West discloses that a rhenium film can be deposited from a carbonyl precursor. The Examiner does not specify that either reference teaches or suggests formation of a silicon-containing passivation layer or a carbon-containing passivation layer as specified in original claim 12 and currently amended claim 1. Despite the Examiner's

Application No. 10/711,717
Response dated December 30, 2005
to Office Action mailed September 30, 2005

statement that the limitations of claims 2-14 have been addressed, it is respectfully suggested that the limitation of original claim 12 was not, in fact, properly addressed by the Examiner.

Applicants find no teaching or suggestion in either the Kaloyeros et al. patent or the West patent of forming a carbon-containing passivation layer or a silicon-containing passivation layer on a rhenium metal layer. For there to be a proper *prima facie* case of obviousness, the combination of references must teach or suggest each element of the claim. Because an element of the claim is not taught or suggested by the combination of references, there can be no proper *prima facie* case of obviousness. Therefore, it is respectfully requested that the rejection of independent claim 1 and its dependent claims over Kaloyeros et al. in view of West be withdrawn.

With respect to claim 8, as amended herein to be rewritten in independent form, again it is respectfully suggested that the limitations of claim 8 were not properly addressed by the Examiner in the comments set forth in the Office Action, and further, that there is no *prima facie* case of obviousness. The method of claim 8 includes exposing the rhenium metal layer to a silicon, carbon, nitrogen, oxygen and/or boron gas and annealing the substrate to diffuse the respective silicon, carbon, nitrogen, oxygen and/or boron into at least a surface portion of the rhenium metal layer to form the passivation layer. Thus, by this method, at least the surface portion of the rhenium metal layer is converted to a rhenium silicide, rhenium carbide, rhenium nitride, rhenium oxide and/or rhenium boride layer. There is simply no teaching or suggestion of a method for forming such a passivation layer in either the Kaloyeros et al. patent or the West patent, alone or in combination. Because the combination of references does not teach or suggest

Application No. 10/711,717
Response dated December 30, 2005
to Office Action mailed September 30, 2005

each element of the claimed invention, there is no *prima facie* case of obviousness. It is therefore respectfully requested that the rejection of independent claim 8 and its dependent claims be withdrawn.

With respect to claim 10, as amended herein to be rewritten in independent form, the method includes forming the passivation layer on the rhenium metal layer by exposing the substrate to a metal carbonyl precursor gas and one or a combination of a silicon-containing gas, a carbon-containing gas, an oxygen-containing gas or a boron-containing gas. The nitrogen-containing gas has been eliminated from the list. The passivation layer formed on the rhenium metal layer is therefore at least one of a metal silicide layer, a metal carbide layer, a metal oxide layer or a metal boride layer. Applicants find no teaching or suggestion in the Kaloyeros et al. patent or the West patent, alone or in combination, of forming this type of passivation layer on a rhenium metal layer. Because the combination of references do not teach or suggest each element of the invention, there is no *prima facie* case of obviousness. It is therefore respectfully requested that the rejection of independent claim 10 and its dependent claims be withdrawn.

Rejection of claims 15-19 over Kaloveros et al. in view of Mittendorf et al.

Applicants are confused by the Examiner's comments with respect to claims 15-19. The Examiner notes that Kaloyeros et al. discloses producing tungsten nitride by reacting the tungsten carbonyl compound with the nitrogen and hydrogen-containing reactant gas, and that the tungsten nitride can be formed with a rhenium film. The Examiner then notes that the reference remains silent on diffusing the rhenium film. Claims 15-19 do not include a step of

Application No. 10/711,717
Response dated December 30, 2005
to Office Action mailed September 30, 2005

diffusing the rhenium film, and it is not certain what the Examiner might be referring to. As amended herein, claim 15 specifies that a tungsten passivation layer is formed on the rhenium layer, and a silicon passivation layer is formed on the tungsten passivation layer. There is no teaching or suggestion in the Kaloyeros et al. patent or the Mittendorf et al. patent, alone or in combination, of forming a rhenium layer on a substrate from a rhenium carbonyl precursor, then forming a tungsten passivation layer on the rhenium layer, and then forming a silicon passivation layer on the tungsten passivation layer. With further respect to dependent claim 22, added by amendment herein, the combination of references also does not teach or suggest annealing the substrate to convert at least a portion of the tungsten and silicon passivation layers to a tungsten silicide passivation layer. Because the combination of references does not teach each and every element of the claim, there can be no *prima facie* case of obviousness. It is therefore respectfully requested that the rejection of independent claim 15 and its dependent claims be withdrawn.

Rejection of claims 1-19 for Double Patenting

With respect to independent claim 1, as amended herein, a silicon-containing passivation layer or a carbon-containing passivation layer is formed on the rhenium metal layer, and silicon and carbon-containing layers are not obvious over a claim to a diffusion barrier layer on a first layer formed from a carbonyl of a metal. It is therefore asserted that the double patenting rejection cannot stand with respect to independent claim 1 and its dependent claims.

With respect to independent claim 8, as amended herein, conversion of at least a surface portion of a rhenium metal layer to a silicide, carbide, nitride, oxide and/or boride of

Application No. 10/711,717
Response dated December 30, 2005
to Office Action mailed September 30, 2005

rhenum is not obvious in view of a claim directed to forming a diffusion barrier layer overlying a first layer. It is respectfully suggested that due consideration was not given to the limitation of original claim 8, and that there is, in fact, no double patenting by claim 8 in view of any of the claims of the Cabral, Jr. et al. patent. It is therefore respectfully requested that the double patenting rejection of independent claim 8 and its dependent claims be withdrawn.

With respect to independent claim 10, as amended herein, the layer formed on the rhenum metal layer is a metal silicide, a metal carbide, a metal oxide and/or a metal boride, which is not obvious in view of a claim directed to a diffusion barrier layer overlying a first metal layer. In addition, the only specification in the claims of the material of the diffusion barrier layer is titanium and titanium nitride, and claim 10 has been amended to exclude metal nitrides. Therefore, it is believed that there is no double patenting by claim 10 in view of any claims of the Cabral, Jr. et al. patent. It is therefore respectfully requested that the double patenting rejection of independent claim 10 and its dependent claims be withdrawn.

With respect to independent claim 15, a rhenum layer is formed from rhenum carbonyl precursor, a tungsten layer is formed overlying the rhenum layer, and a silicon layer is formed overlying the tungsten layer. There is no claim in the Cabral, Jr. et al. patent directed to this specific construction of Re/W/Si, and this specific construction is not obvious in view of the claims of Cabral, Jr. et al.. It is therefore respectfully requested that the double patenting rejection of independent claim 15 and its dependent claims be withdrawn.

Application No. 10/711,717
Response dated December 30, 2005
to Office Action mailed September 30, 2005

In view of the foregoing amendments to the claims and remarks given herein, Applicants respectfully believe this case is in condition for allowance and respectfully request allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

Applicants are of the opinion that an additional fee of \$400 is due as a result of this Amendment. Please consider this authorization to charge the \$400 fee to Deposit Account No. 23-3000. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,

WOOD, HERRON & EVANS LLP.

By: 
Kristi L. Davidson, Reg. No. 44,643

2700 Carew Tower
441 Vine Street
Cincinnati, OH 45202
513/241-2324 (voice)
513/241-6234 (facsimile)
K:\user\DCG\WORD docs\response to OA format.doc

End of Facsimile Transmission

for Serial No. 10/711,717

THANK YOU

Wood, Herron & Evans, LLP
2700 Carew Tower
441 Vine Street
Cincinnati, OH 45202
513-241-2324 (voice)
513-241-6234 (fax)

December 30, 2005